

## PATENT ABSTRACTS OF JAPAN

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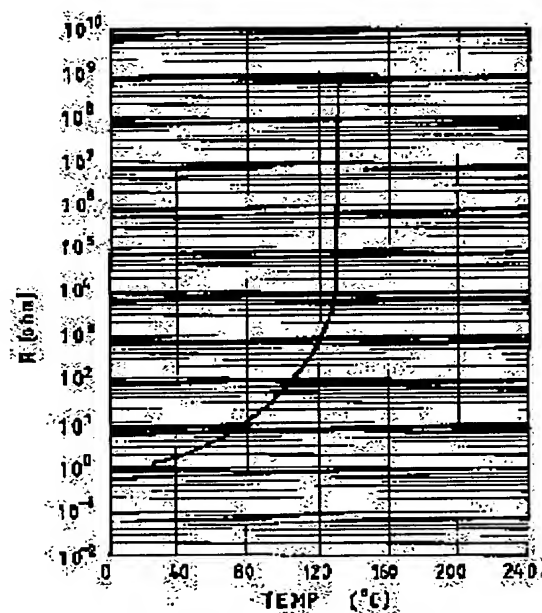
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## (54) ORGANIC POSITIVE TEMPERATURE COEFFICIENT CHARACTERISTICS THERMISTOR

## (57)Abstract:

PURPOSE: To provide an organic positive temperature coefficient characteristic thermistor which has a steep rise of the PTC characteristics and shows a large resistance change and, further, has little variation of a resistance value.

CONSTITUTION: The organic positive temperature coefficient characteristics thermistor of the present invention is made of the mixture of thermosetting resin and conductive particles having spike-type protrusions. As the mixture of the conductive particles having spike-type protrusions facilitates the flow of a tunnel current because of the shapes of the particles and has better conducting properties than the mixture of purely spherical conductive particles, an initial resistance value at a room temperature can be lowered. As the distance between the conductive particles is larger than the distance between spherical conductive particles, the rise of the PTC characteristics is steep and a large resistance change is provided. The variation of the resistance is smaller than that of the mixture of fiber-type conductive particles. As the thermosetting resin is employed, the thermistor is in flammable and, in comparison with a thermister employing thermoplastic resin, a cross-linking process can be eliminated and excellent effects such as the simplification of processes can be obtained.



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CLAIMS

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[Claim(s)]

[Claim 1] The organic positive thermistor characterized by coming to mix thermosetting resin and the conductive particle which has the projection of the letter of a spike.

[Claim 2] The organic positive thermistor according to claim 1 which makes the content of said conductive particle 5 thru/or 65 % of the weight.

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## DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention relates to the organic positive thermistor which has the property, i.e., a PTC (Positive Temperature Coefficient) property, that resistance increases rapidly in the temperature field of the time specification of a temperature up in more detail about an organic positive thermistor.

[0002]

[Description of the Prior Art] Conventionally, the thing which made thermosetting resin, such as a thing which made thermoplastics, such as polyethylene or a polypropylene pin, distribute metal powder and carbon black, and an epoxy resin, polyimide, unsaturated polyester and silicon (for example, U.S. Pat. No. 3591526 specification etc.), polyurethane, phenol resin, distribute fibrous conductive material, such as a carbon fiber, a graphite fiber, graphite lamellar compound fiber, a metal fiber, and ceramic fiber, etc. as an organic positive thermistor is known (for example, U.S. Pat. No. 4966729 specification etc.).

[0003] Although such an organic positive thermistor can be applied to a thermometric element or an autogenous regulation mold heater, the standup of a PTC property presents a steep and big change in resistance, and it needs for the initial resistance in a room temperature to be small moreover.

[0004]

[Problem(s) to be Solved by the Invention] However, in the conventional organic positive thermistor, since bridge formation processing and nonflammable-ized processing were required, and the distributed conductive matter was fibrous when it is thermosetting resin, in the case of thermoplastics, dispersion in resistance was large, and it had the problem that it was difficult to lower initial resistance.

[0005] Then, this invention is made in view of the above-mentioned situation, the initial resistance in a room temperature is small, a steep and big change in resistance is presented and, moreover, the standup of a PTC property aims to let dispersion in resistance offer a small organic positive thermistor.

[0006]

[Means for Solving the Problem] In order to attain the above-mentioned purpose, invention according to claim 1 is an organic positive thermistor characterized by coming to mix thermosetting resin and the conductive particle which has the projection of the letter of a spike.

[0007] Moreover, invention according to claim 2 makes the content of said conductive particle 5 thru/or 65 % of the weight in invention according to claim 1.

[0008]

[Function] Since the particle which has the projection of the letter of a spike as a conductive particle mixed with thermosetting resin is used according to invention according to claim 1, since the configuration, therefore tunnel current become easy to flow and conductivity becomes good, the initial resistance in a room temperature becomes small by the conductive particles which have the projection of the letter of a spike compared with the case where a conductive true ball-like particle is mixed. Moreover, since spacing of conductive particles is large compared with a spherical thing, it goes out easily in a point of contact, and the standup of a PTC property presents a steep and big change in resistance. Moreover, compared with the case where a fibrous conductive particle is mixed, dispersion in resistance becomes small.

[0009] Furthermore, since thermosetting resin is used as resin mixed with a conductive particle, it is incombustibility, and compared with the case where thermoplastics is used, bridge formation processing becomes unnecessary and the effectiveness which was [ simplify / a production process ] excellent is acquired.

[0010] According to invention according to claim 2, said characteristic effectiveness by having made the projection of the letter of a spike into the particle which it has becomes more remarkable in a conductive particle about the content of a conductive particle 5 thru/or by considering as 20 thru/or 55 % of the weight preferably 65% of the weight.

[0011]

[Example] Hereafter, the example of this invention is explained in full detail.

[0012] The organic positive thermistor of one example of this invention comes to mix the conductive particle and curing agent with which it has thermosetting resin as base resin (matrix), and it has the projection of the letter of a spike as a filler.

[0013] As said thermosetting resin, there are an epoxy resin, polyimide, unsaturated polyester, silicon, polyurethane, phenol resin, etc. Thermosetting resin can be suitably chosen according to the desired engine performance, an application, etc., and an epoxy resin (Ciba-Geigy Araldite F) is used for it by this example.

[0014] The mean particle diameter 2.2 thru/or the 2.8 micrometers (it measures by the Fischer subsieve method) filament-like chain-like nickel powder (parakeet company make) with which effectiveness equivalent to nickel powder which has the projection of mean particle diameter 3 thru/or the 7-micrometer letter of a spike as a conductive particle which has the projection of said letter of a spike is acquired is used.

[0015] The Ciba-Geigy hardener is used as said curing agent.

[0016] As the 1 manufacture approach of said organic positive thermistor, said each organization of the specified quantity is mixed (vacuum churning degassing), this is slushed between electrodes (for example, nickel foil), press forming is carried out to the shape of a sheet, and a tabular organic positive thermistor is obtained by punching after hardening this (140 degrees C, 1 hour as [ Considering as precure. ] 80 degrees C, 30 minutes, and this hardening).

[0017] Thus, the effectiveness acquired by the constituted organic positive thermistor is explained with reference to Table 1 and drawing 1 thru/or drawing 5. Table 1 shows the initial resistance and resistance temperature characteristic in a room temperature of the organic positive thermistor into which the rate of each organization was changed. Drawing 1 thru/or drawing 6 make a graph each of the example 1 in Table 1 thru/or 4, and the examples 1 and 2 of a comparison.

[0018]

[Table 1]

	主 剤 (アラルダイトF) (wt%)	硬化剤 (ハードナー) (wt%)	フィラー (Niパウダー) (wt%)	フィラー (ドナカボ) (wt%)	初 期 抵抗値 ( $\Omega$ )	抵 抗 変化率
実施例 1	77.0	18.0	5.0	—	1.5	$10^9$ 以上
実施例 2	48.75	11.25	40.0	—	0.1	$10^9$ 以上
実施例 3	32.5	7.5	60.0	—	0.03	$10^9$ 以上
実施例 4	24.5	5.5	70.0	—	0.01	$10^3$
比較例 1	79.3	18.5	—	2.5	10	$10^{3.5}$
比較例 2	65.0	15.0	—	20.0	0.5	$10^2$

As shown in Table 1, the example 1 thru/or the sample of 4 mixed what changed the rate of each organization of Araldite F, a hardener, and nickel powder (vacuum churning degassing), and it slushed this between electrodes (nickel foil), it carried out press forming to the shape of a sheet, and what was pierced to disc-like [ with a diameter of 10mm ] was used for it after hardening this (140 degrees C, 1 hour as [ Considering as precure. ] 80 degrees C, 30 minutes, and this hardening).

[0019] The carbon fiber (DONAKABO; the product made from Kansai tar, die length of 0.7mm, diameter of 10mm) was used for the sample of the examples 1 and 2 of a comparison instead of nickel powder as a filler.

[0020] An example 1 thru/or 4, and the examples 1 and 2 of a comparison put in the above-mentioned sample in the thermostat, performed a temperature rise and descent, and measured the resistance of whenever [ constant temperature ] everywhere, and measurement of a PTC property asked for the relation between temperature and resistance.

[0021] (a) Since the particle which has the projection of the letter of a spike as a conductive particle was used, since the configuration, therefore tunnel current became easy to flow and conductivity became good, the initial resistance in a room temperature became small by the conductive particles which have the projection of the letter of a spike compared with the case where a conductive true ball-like particle is mixed. In the example 1, in 1.5 ohms and an example 2, it was set to 0.03 ohms in 0.10 ohms and the example 3, and was set 0.01 ohms by the example 4. In the example 1 of a comparison, it was set to 0.5 ohms in 10 ohms and the example 2 of a comparison. In addition, at less than 5 % of the weight, resistance rose conversely, and the addition of nickel powder brought a result which cannot be used as a thermistor.

[0022] (b) Since spacing of the conductive particles which have the projection of the letter of a spike was large compared with the spherical thing, it went out easily in the point of contact, and the standup of a PTC property presented the steep and big change in resistance. In the example 1, resistance rises rapidly with transition temperature, and the maximum resistance is  $1 \times 10^9$ . It is set to  $\omega$  and resistance rate of change is 109. It became the above high value. At the example 2 as well as an example 1, resistance rate of change is 109. It became the above high value. Although the initial resistance in a room temperature is 0.01 ohms and a low value in the example 4 as mentioned above, since the filler is superfluously contained, the electric conduction path is not intercepted in transition temperature, but resistance rate of change is 103. The rapid resistance rise was not seen. At the example 1 of a comparison, resistance rate of change is 103.5. The rapid resistance rise was not seen. Although the resistance in a room temperature is 0.5 ohms and a low value in the example 2 of a comparison as mentioned above, resistance rate of change is 102. The rapid resistance rise was not seen.

[0023] (c) Since the particle which has the projection of the letter of a spike as a conductive particle is used, compared with the case where a fibrous conductive particle is mixed, dispersion in resistance becomes small. In the example 1, there is no fall of resistance also in the temperature of 130 degrees C or more which is the maximum resistance, and the deformation by the heat of a sample is not produced.

[0024] therefore, the above (a), (b), and (c) the addition of nickel powder which is a filler in order for this invention to obtain the target thermistor -- 5 -- or it is thought that 20 thru/or 55 % of the weight are preferably suitable 65% of the weight.

[0025] (d) Since thermosetting resin is used as resin mixed with a conductive particle, it is incombustibility, and in the case of thermoplastics, in order to suppress a NTC phenomenon, compared with the case where thermoplastics is used, the indispensable bridge formation processing becomes unnecessary. Moreover, since bridge formation processing becomes unnecessary and sheet-izing of a thermistor and electrode attachment can be performed in one, compared with the case of thermoplastics, the effectiveness which was [ simplify / a production process ] excellent is acquired.

[0026] in addition, this invention is not limited to the above-mentioned example, but within limits which do not change the summary, is boiled variously and can carry out deformation implementation.

[0027]

[Effect of the Invention] Since the particle which has the projection of the letter of a spike as a conductive particle is used according to invention according to claim 1 explained in full detail above, since the configuration, therefore tunnel current become easy to flow and conductivity becomes good, the initial resistance in a room temperature becomes small by the conductive particles which have the projection of the letter of a spike compared with the case where a conductive true ball-like particle is mixed. Moreover, since spacing of conductive particles is large compared with a spherical thing, it goes out easily in a point of contact, and the standup of a PTC property presents a steep and big change in resistance. Moreover, compared with the case where a fibrous conductive particle is mixed, dispersion in resistance becomes small. Furthermore, since thermosetting resin is used as resin mixed with a conductive particle, compared with the case where thermoplastics is used, incombustibility improves, bridge formation processing becomes unnecessary, and simplification of a production process etc. can be attained. Therefore, the organic positive thermistor which has the effectiveness which was [ be / moreover / the standup of a PTC property presents a steep and big change in resistance, and / dispersion in resistance / the initial resistance in a room temperature is small, / small ] excellent can be offered.

[0028] Moreover, since the content of a conductive particle is made into 5 thru/or 65 % of the weight according to invention according to claim 2 Since the effectiveness according to claim 1 by having made the conductive particle into the particle which has the projection of the letter of a spike becomes more remarkable The organic

positive thermistor which has the effectiveness which was [ be / moreover / the standup of a PTC property presents a steep and big change in resistance, and / dispersion in resistance / the initial resistance in a room temperature is smaller than invention according to claim 1, / small ] excellent can be offered.

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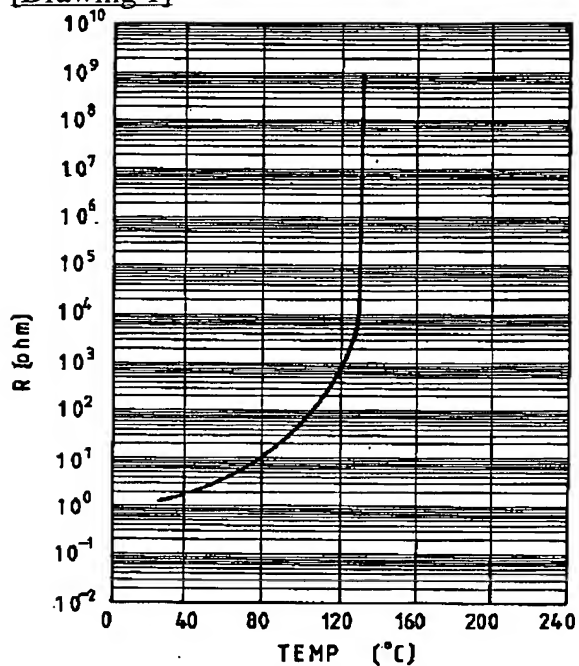
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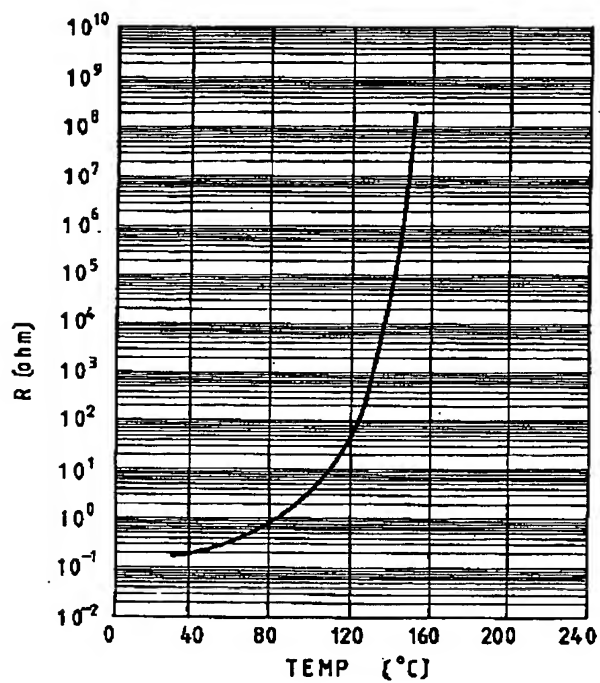
DRAWINGS

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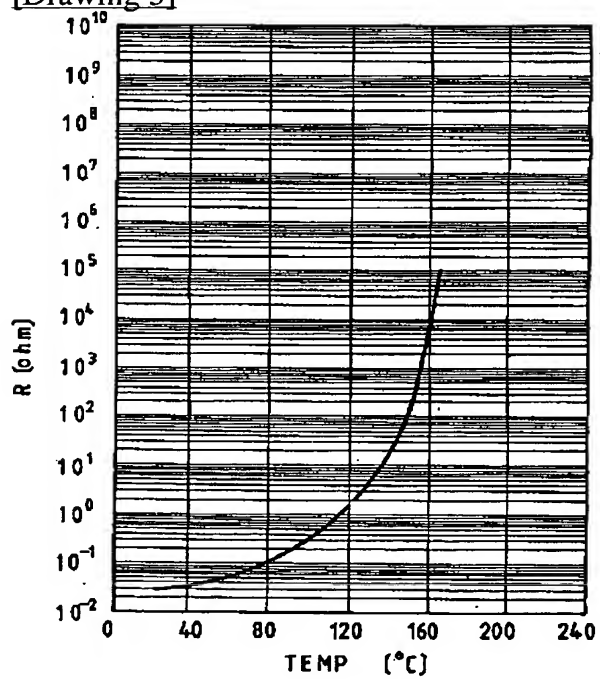
[Drawing 1]



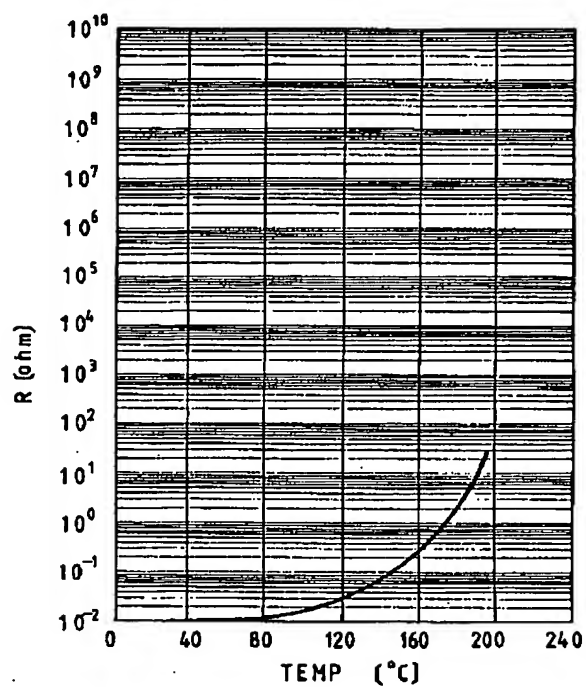
[Drawing 2]



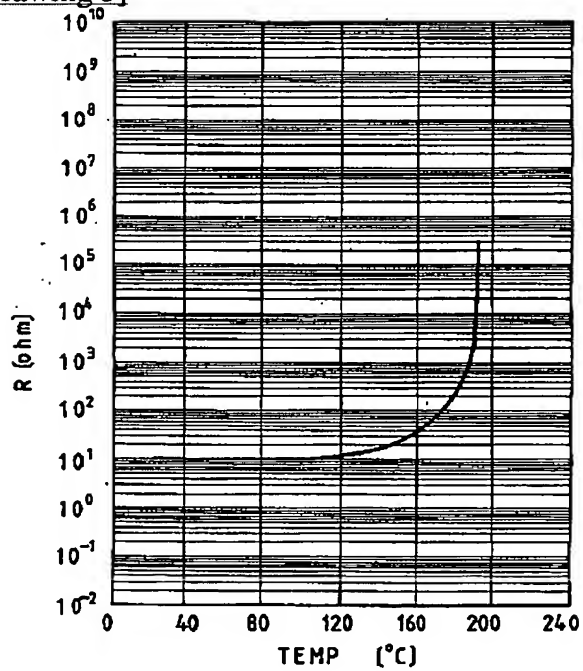
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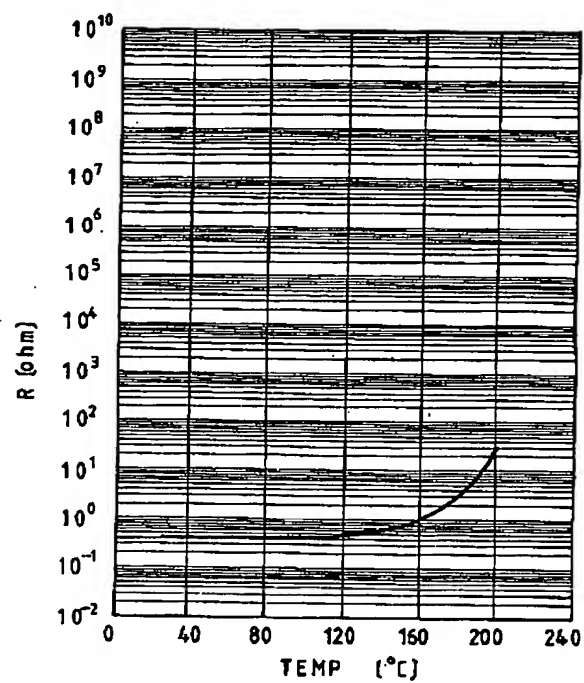
[Drawing 4]



[Drawing 5]



[Drawing 6]



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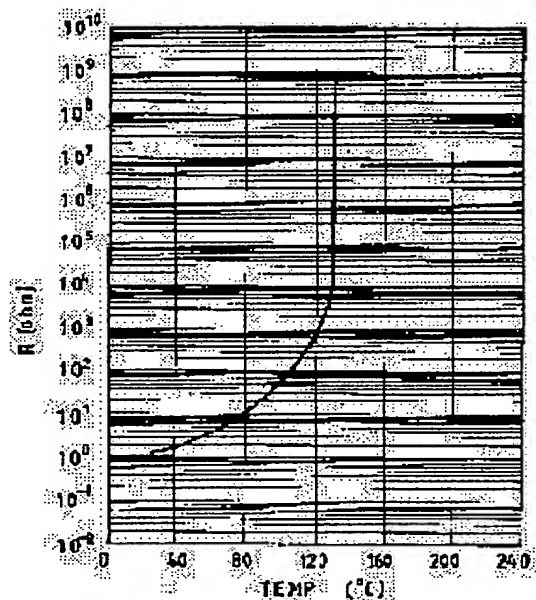
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### (57)Abstract:

**PURPOSE:** To provide an organic positive temperature coefficient characteristic thermistor which has a steep rise of the PTC characteristics and shows a large resistance change and, further, has little variation of a resistance value.

**CONSTITUTION:** The organic positive temperature coefficient characteristics thermistor of the present invention is made of the mixture of thermosetting resin and conductive particles having spike-type protrusions. As the mixture of the conductive particles having spike-type protrusions facilitates the flow of a tunnel current because of the shapes of the particles and has better conducting properties than the mixture of purely spherical conductive particles, an initial resistance value at a room temperature can be lowered. As the distance between the conductive particles is larger than the distance between spherical conductive particles, the rise of the PTC characteristics is steep and a large resistance change is provided. The variation of the resistance is smaller than that of the mixture of fiber-type conductive particles. As the thermosetting resin is employed, the thermistor is in flammable and, in comparison with a thermistor employing thermoplastic resin, a cross-linking process can be eliminated and excellent effects such as the simplification of processes can be obtained.



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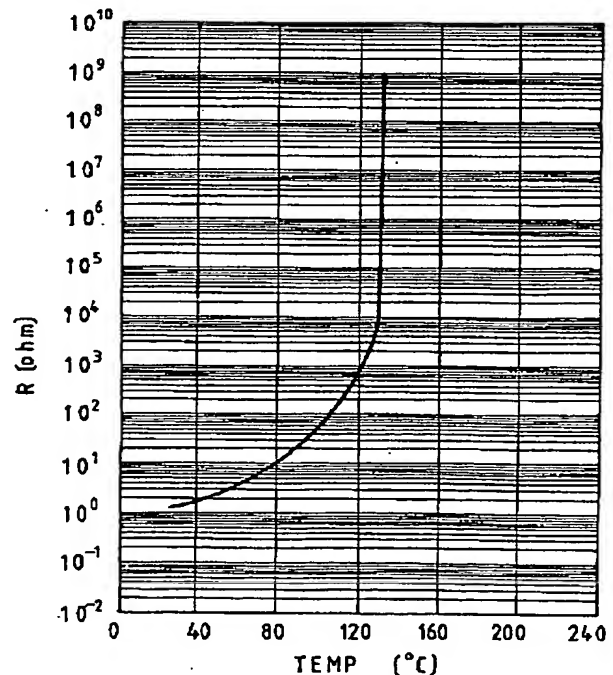
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(54)【発明の名称】 有機質正特性サーミスタ

(57)【要約】

【目的】 PTC特性の立ち上がりが急峻で大きな抵抗値変化を呈し、しかも抵抗値のばらつきが小さい有機質正特性サーミスタを提供する。

【構成】 本有機質正特性サーミスタは、熱硬化性樹脂とスパイク状の突起を有する導電性粒子とを混合してなるものである。スパイク状の突起を有する導電性粒子同士では、真球状の導電性粒子を混合した場合に比べ、その形状故にトンネル電流が流れやすくなって、導電性が良好となるため、室温での初期抵抗値が小さくなる。導電性粒子同士の間隔が球状のものに比べて大きいので、PTC特性の立ち上がりが急峻で大きな抵抗値変化を呈する。繊維状の導電性粒子を混合した場合に比べ、抵抗値のばらつきが小さくなる。熱硬化性樹脂を用いているので、不燃性であり、熱可塑性樹脂を用いた場合に比べ、架橋処理が不要となり、製造工程を簡略化できる等の優れた効果が得られる。



## 【特許請求の範囲】

【請求項1】 熱硬化性樹脂とスパイク状の突起を有する導電性粒子とを混合してなることを特徴とする有機質正特性サーミスタ。

【請求項2】 前記導電性粒子の含有量を5乃至65重量%とする請求項1記載の有機質正特性サーミスタ。

## 【発明の詳細な説明】

## 【0001】

【産業上の利用分野】本発明は、有機質正特性サーミスタに関し、より詳しくは、昇温時特定の温度領域で急激に抵抗値が増大する特性、すなわち、PTC (Positive Temperature Coefficient) 特性を有する有機質正特性サーミスタに関する。

## 【0002】

【従来の技術】従来、有機質正特性サーミスタとして、ポリエチレン若しくはポリプロピレン等の熱可塑性樹脂に金属粉末やカーボンブラックを分散させたもの（例えば、米国特許第3591526号明細書等）や、エポキシ樹脂、ポリイミド、不飽和ポリエステル、シリコン、ポリウレタン及びフェノール樹脂等の熱硬化性樹脂に、炭素繊維、黒鉛繊維、黒鉛層間化合物繊維、金属繊維及びセラミック繊維等の繊維状導電物質等を分散させたものが知られている（例えば、米国特許第4966729号明細書等）。

【0003】このような有機質正特性サーミスタは、例えば温度検出器又は自己制御型ヒーター等に適用し得るが、PTC特性の立ち上がりが急峻で大きな抵抗値変化を呈し、しかも室温での初期抵抗値が小さいことが必要である。

## 【0004】

【発明が解決しようとする課題】しかし、従来の有機質正特性サーミスタにおいては、熱可塑性樹脂の場合は、架橋処理や不燃化処理が必要であり、熱硬化性樹脂の場合は、分散された導電性物質が繊維状であるため、抵抗値のばらつきが大きく、また、初期抵抗値を下げるのが難しいという問題があった。

【0005】そこで、本発明は、上記事情に鑑みてなされたものであり、室温での初期抵抗値が小さく、PTC特性の立ち上がりが急峻で大きな抵抗値変化を呈し、しかも抵抗値のばらつきが小さい有機質正特性サーミスタを提供することを目的とする。

## 【0006】

【課題を解決するための手段】上記目的を達成するために請求項1記載の発明は、熱硬化性樹脂とスパイク状の突起を有する導電性粒子とを混合してなることを特徴とする有機質正特性サーミスタである。

【0007】また、請求項2記載の発明は、請求項1記載の発明において、前記導電性粒子の含有量を5乃至65重量%とするものである。

## 【0008】

【作用】請求項1記載の発明によれば、熱硬化性樹脂と混合する導電性粒子としてスパイク状の突起を有する粒子を用いているので、真球状の導電性粒子を混合した場合に比べ、スパイク状の突起を有する導電性粒子同士では、その形状故にトンネル電流が流れやすくなって、導電性が良好となるため、室温での初期抵抗値が小さくなる。また、導電性粒子同士の間隔が球状のものに比べて大きいので、接触点で容易に切れてPTC特性の立ち上がりが急峻で大きな抵抗値変化を呈する。また、繊維状の導電性粒子を混合した場合に比べ、抵抗値のばらつきが小さくなる。

【0009】更に、導電性粒子と混合する樹脂として熱硬化性樹脂を用いているので、不燃性であり、熱可塑性樹脂を用いた場合に比べ、架橋処理が不要となり、製造工程を簡略化できる等の優れた効果が得られる。

【0010】請求項2記載の発明によれば、導電性粒子の含有量を5乃至65重量%好ましくは20乃至55重量%とすることにより、導電性粒子をスパイク状の突起を有する粒子としたことによる前記特有の効果がより顕著となる。

## 【0011】

【実施例】以下、本発明の実施例を詳述する。

【0012】本発明の一実施例の有機質正特性サーミスタは、主剤（マトリックス）として熱硬化性樹脂、フィラーとしてスパイク状の突起を有する導電性粒子及び硬化剤を混合してなるものである。

【0013】前記熱硬化性樹脂としては、エポキシ樹脂、ポリイミド、不飽和ポリエステル、シリコン、ポリウレタン及びフェノール樹脂等がある。熱硬化性樹脂は、所望の性能、用途等に応じて適宜選択することができ、本実施例では、エポキシ樹脂（チバガイギー製のアラライトF）を用いる。

【0014】前記スパイク状の突起を有する導電性粒子としては、平均粒径3乃至7 $\mu$ mのスパイク状の突起を有するNiパウダーと同等の効果が得られる平均粒径2.2乃至2.8 $\mu$ m（フィッシャー・サブシブ法で測定）のフィラメント状鎖状Niパウダー（インコ社製）を用いる。

【0015】前記硬化剤としては、チバガイギー製のハードナーを用いる。

【0016】前記有機質正特性サーミスタの一製造方法としては、所定量の前記各組織を混合（真空攪拌脱泡）し、これを電極（例えばNi箔）間に流し込んでシート状にプレス成形し、これを硬化（予備硬化として80℃、30分、本硬化として140℃、1時間）後、パンチングにより板状の有機質正特性サーミスタを得る。

【0017】このように構成された有機質正特性サーミスタにより得られる効果を、表1及び図1乃至図5を参照して説明する。表1は各組織の割合を変えた有機質正特性サーミスタの室温での初期抵抗値及び抵抗温度特

性を示すものである。図1乃至図6は、表1における実施例1乃至4及び比較例1、2のそれぞれをグラフにしたものである。

【0018】

【表1】

	主 剤 (アラミダイ F) (wt%)	硬化剤 (ハードナー) (wt%)	フィラー (Niパウダー) (wt%)	フィラー (ドナカーボ) (wt%)	初 期 抵抗値 ( $\Omega$ )	抵 抗 変化率
実施例1	77.0	18.0	5.0	—	1.5	$10^9$ 以上
実施例2	48.75	11.25	40.0	—	0.1	$10^9$ 以上
実施例3	32.5	7.5	60.0	—	0.03	$10^9$ 以上
実施例4	24.5	5.5	70.0	—	0.01	$10^9$
比較例1	79.3	18.5	—	2.5	10	$10^{3.5}$
比較例2	65.0	15.0	—	20.0	0.5	$10^2$

実施例1乃至4のサンプルは、表1に示すように、アラミダイ F、ハードナー、Niパウダーの各組織の割合を変えたものを混合（真空攪拌脱泡）し、これを電極（Ni箔）間に流し込んでシート状にプレス成形し、これを硬化（予備硬化として80℃、30分、本硬化として140℃、1時間）後、直径10mmの円板状に打ち抜いたものを用いた。

【0019】比較例1、2のサンプルは、フィラーとしてNiパウダーの代りに炭素繊維（ドナカーボ；関西タール製、長さ0.7mm、直径10mm）を用いた。

【0020】PTC特性の測定は、実施例1乃至4及び比較例1、2ともに、上記サンプルを恒温槽内に入れ、温度上昇及び下降を行い、各所定温度における抵抗値を測定し、温度と抵抗値との関係を求めた。

【0021】(a) 導電性粒子としてスパイク状の突起を有する粒子を用いているので、真球状の導電性粒子を混合した場合に比べ、スパイク状の突起を有する導電性粒子同士では、その形状故にトンネル電流が流れやすくなって、導電性が良好となるため、室温での初期抵抗値が小さくなった。実施例1では1.5 $\Omega$ 、実施例2では0.10 $\Omega$ 、実施例3では0.03 $\Omega$ 、実施例4では0.01 $\Omega$ となった。比較例1では10 $\Omega$ 、比較例2では0.5 $\Omega$ となった。なお、Niパウダーの添加量が5重量%未満では、抵抗値が逆に上昇してしまい、サーミスタとして使用できない結果となった。

【0022】(b) スパイク状の突起を有する導電性粒子同士の間隔が球状のものに比べて大きいので、接触点で容易に切れてPTC特性の立ち上がりが急峻で大きな抵抗値変化を呈した。実施例1では、転移温度では抵抗値が急激に上昇して最大抵抗値は $1 \times 10^9 \Omega$ になり、抵抗変化率は $10^9$ 以上の高い値となった。実施例2でも、実施例1と同様に抵抗変化率は $10^9$ 以上の高い値となった。実施例4では、室温での初期抵抗値は上述したように0.01 $\Omega$ と低い値であるが、フィラーが過剰に入っているため、転移温度においてもその導電経路が遮断されず、抵抗変化率は $10^3$ と急激な抵抗上昇は見

られなかった。比較例1では、抵抗変化率は $10^{3.5}$ と急激な抵抗上昇は見られなかった。比較例2では、室温での抵抗値は前述したように0.5 $\Omega$ と低い値であるが、抵抗変化率は $10^2$ と急激な抵抗上昇は見られなかった。

【0023】(c) 導電性粒子としてスパイク状の突起を有する粒子を用いているので、繊維状の導電性粒子を混合した場合に比べ、抵抗値のばらつきが小さくなる。実施例1では、最大抵抗値である130℃以上の温度においても抵抗値の低下はなく、サンプルの熱による変形は生じていない。

【0024】従って、上記(a),(b),(c)より、本発明が目的としているサーミスタを得るには、フィラーであるNiパウダーの添加量は、5乃至65重量%好ましくは20乃至55重量%が適していると思われる。

【0025】(d) 導電性粒子と混合する樹脂として熱硬化性樹脂を用いているので、不燃性であり、熱可塑性樹脂を用いた場合に比べ、熱可塑性樹脂の場合ではNTC現象を抑えるために必要不可欠であった架橋処理が不要となる。また、架橋処理が不要となり、サーミスタのシート化及び電極付けを一体的に行えるので、熱可塑性樹脂の場合に比べ、製造工程を簡略化できる等の優れた効果が得られる。

【0026】なお、本発明は上記実施例に限定されず、その要旨を変更しない範囲内で種々に変形実施できる。

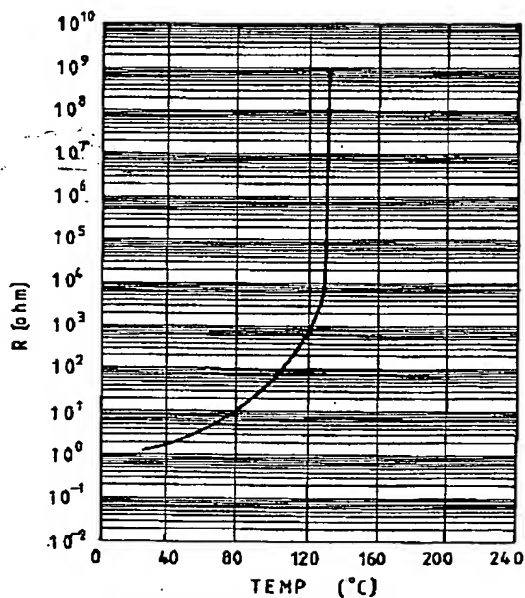
【0027】

【発明の効果】以上詳述した請求項1記載の発明によれば、導電性粒子としてスパイク状の突起を有する粒子を用いているので、真球状の導電性粒子を混合した場合に比べ、スパイク状の突起を有する導電性粒子同士では、その形状故にトンネル電流が流れやすくなって、導電性が良好となるため、室温での初期抵抗値が小さくなる。また、導電性粒子同士の間隔が球状のものに比べて大きいので、接触点で容易に切れてPTC特性の立ち上がりが急峻で大きな抵抗値変化を呈する。また、繊維状の導電性粒子を混合した場合に比べ、抵抗値のばらつきが小

さくなる。更に、導電性粒子と混合する樹脂として熱硬化性樹脂を用いているので、熱可塑性樹脂を用いた場合に比べ、不燃性が向上し、架橋処理が不要となり、製造工程の簡略化等が図れる。従って、室温での初期抵抗値が小さく、PTC特性の立ち上がりが急峻で大きな抵抗値変化を呈し、しかも抵抗値のばらつきが小さい等の優れた効果を有する有機質正特性サーミスタを提供することができる。

【0028】また、請求項2記載の発明によれば、導電性粒子の含有量を5乃至65重量%としているので、導電性粒子をスパイク状の突起を有する粒子としたことによる請求項1記載の効果がより顕著となるので、請求項1記載の発明よりも室温での初期抵抗値が小さく、PTC特性の立ち上がりが急峻で大きな抵抗値変化を呈し、しかも抵抗値のばらつきが小さい等の優れた効果を有す

【図1】



る有機質正特性サーミスタを提供することができる。

【図面の簡単な説明】

【図1】本発明の有機質正特性サーミスタの実施例1の抵抗温度特性を示すグラフである。

【図2】本発明の有機質正特性サーミスタの実施例2の抵抗温度特性を示すグラフである。

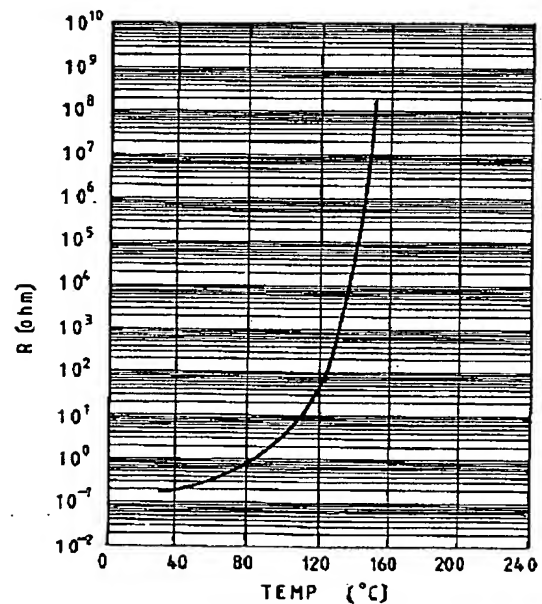
【図3】本発明の有機質正特性サーミスタの実施例3の抵抗温度特性を示すグラフである。

【図4】本発明の有機質正特性サーミスタの実施例4の抵抗温度特性を示すグラフである。

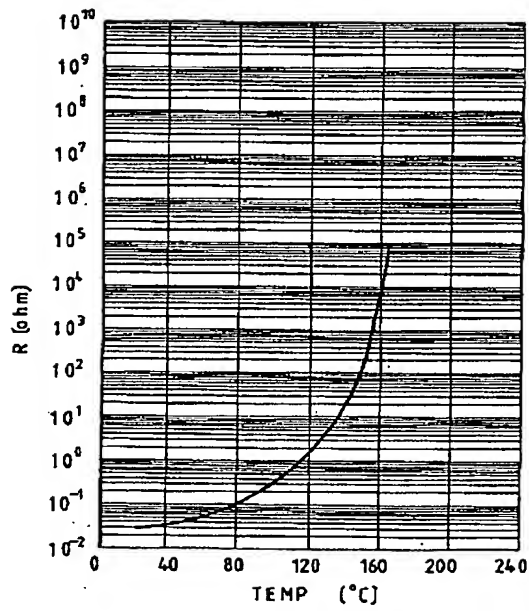
【図5】有機質正特性サーミスタの比較例1の抵抗温度特性を示すグラフである。

【図6】有機質正特性サーミスタの比較例2の抵抗温度特性を示すグラフである。

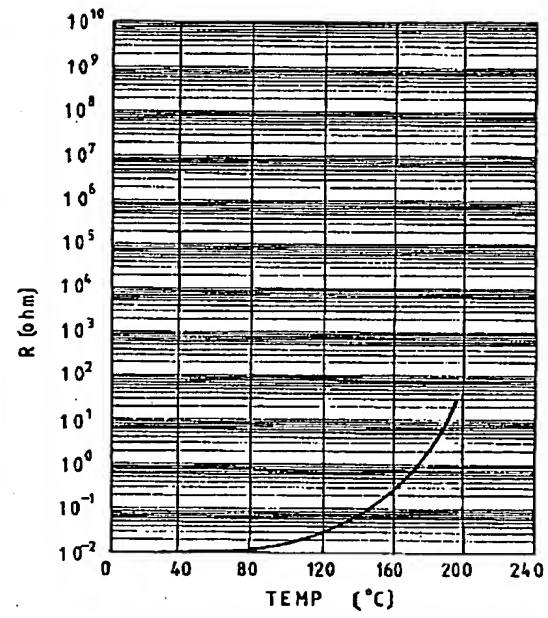
【図2】



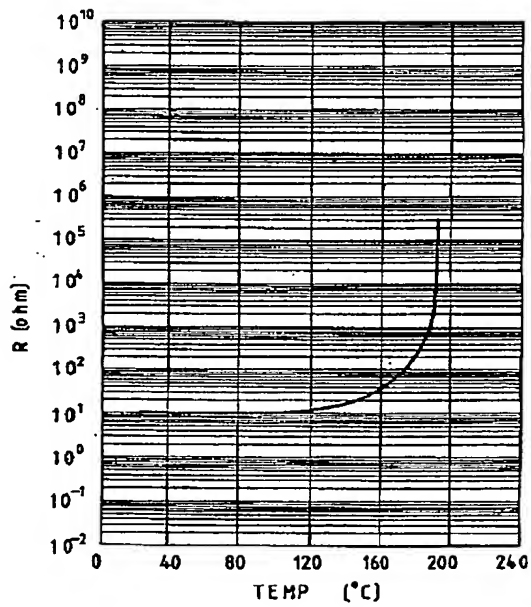
【図3】



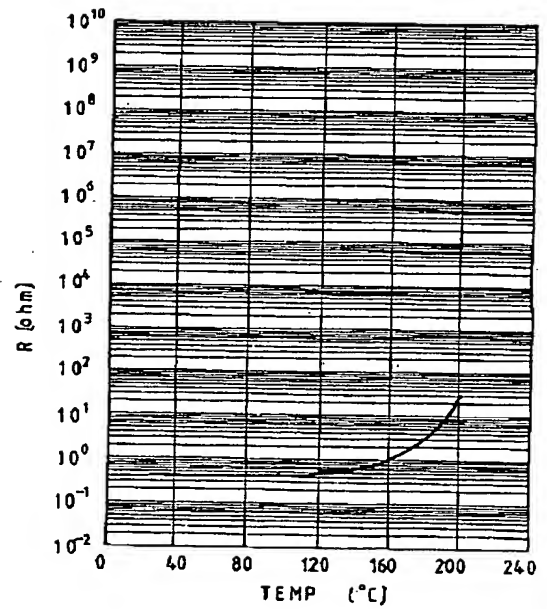
【図4】



【図5】



【図6】



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